

3 ENVIRONMENTAL SETTING OF THE LOWER GREEN RIVER

This section provides an overview of the historic and current physical characteristics and salmonid populations in the Lower Green River. Much of this information is derived from the *Habitat Limiting Factors and Reconnaissance Report* (Kerwin and Nelson 2000), which can be referred to for more detailed information.

3.1 Physical Characteristics

The physical land area of WRIA 9 (Green/Duwamish River watershed) covers 460 square miles and is divided into five sub-watersheds. The Lower Green River sub-watershed extends from RM 32 to RM 11.0 at the confluence of the Black River and the beginning of the estuary. However, the study area for this survey project was extended to include RM 11.0 to RM 5.7, which comprises the reach between the Black River and the North Wind Weir in Tukwila, just upstream from the Duwamish Turning Basin (Figure 2-1). The summary statistics provided in this section are based on calculations from RM 32 to RM 11.0.

3.1.1 Historic Conditions

The geologic history and fluvial characteristics of the Lower Green River have been important in determining the type and quantity of habitat that formed in the watershed. Geologically, the Upper Green River (upstream of the Howard Hanson Dam at RM 64.5) and Middle Green River (RM 64.5 to RM 32) sub-watershed are composed primarily of Puget Group hard rock; whereas the Lower Green River sub-watershed consists primarily of continental glacial till (Fuerstenberg et al. 1996). Historically, this till provided a source of sediment to the lower sub-watershed through the movement of bedload material. The slope of the Middle Green River flattens below the Green River Gorge at RM 46, and again at the former confluence of the White River in Auburn. As a result, most of the river's coarse bedload is deposited throughout the Middle Green River and upper third of the Lower Green River sections, while finer-grained sand and silt is transported further downstream as suspended sediment, eventually settling out to form the extensive floodplain, deltaic wetland, and marsh system in the historic Duwamish River estuary.

Historically, the forests of the Middle and Lower Green River floodplain and riparian zone were dominated by mature black cottonwood and bigleaf maples (Collins and

Sheikh 2003). These forests were well connected to the floodplain and provided the lower river with a ready and ample source of wood.

3.1.2 Human Impacts and Current Conditions

Changes in flow due to diversions of the White, Cedar, and Black Rivers in the early 1900s for flood control and other purposes reduced the drainage and sediment supply to the Lower Green River, leading to changes in the floodplain conditions. Drainage of the entire Green River watershed was reduced by almost 60 percent due to the diversions of these rivers (Weitkamp et al. 2000; Kerwin and Nelson 2000) and stream flows were reduced accordingly. According to Kerwin and Nelson (2000), the White River diversion reduced summer flows in the Lower Green River by roughly 50 percent and sediment supply by 75 percent. As a result of these diversions, the channel narrowed downstream of RM 32.1, causing the formation of a new, much narrower floodplain within the old channel which was approximately 7 feet lower than the former floodplain. This resulted in a substantial disconnection of many acres of side-channels. In addition, coarse sediment delivery decreased and fine sedimentation increased, resulting in the loss of gravel bars and an overall decrease in mean substrate particle size in the Lower Green River.

In the last century, the channelization of the Lower Green River has resulted in substantial losses in riparian ecosystem extent and quality and wood inputs to the river. Eighty percent of the shoreline from RM 17 to 33 has been armored for flood protection (Kerwin and Nelson 2000), leading to a reduction in forest margin areas. As early as 1936, the Lower Green River had as little as 8 percent tree cover in the riparian zone extending 300 feet on either side of the river (Fuerstenberg et al. 1996). In addition, the channelization of the river has eliminated bank erosion processes and precluded wood recruitment. Currently, riparian vegetation consists mostly of non-native grasses and blackberries that provide little shade or detrital input.

Since 1962, the U.S. Army Corps of Engineers has operated the Howard Hanson Dam (RM 64.5) for flood control purposes, so that runoff peaks are reduced in the Lower Green River. However, some flooding can still occur due to overbank flow from local tributaries.

The nearly continuous channelization of the Lower Green River and construction of Howard Hanson Dam have enabled substantial development in the floodplain for various purposes. The shoreline of the Lower Green River currently follows a gradient of increasing urbanization from its confluence with Soos Creek to the beginning of the estuary. In the Lower Green River sub-watershed, residential development constitutes 50 percent of land use; while industrial, commercial, and agricultural development represent 17 percent, 10 percent, and 5 percent, respectively (Kerwin and Nelson 2000).

Currently, the Lower Green River retains its sinuous form of the 1800s but is mostly revetted and lacks the historic side channels and sloughs characteristic of the pre-Euro-American-settlement river. In a comparison of aerial photos, total vegetation acreage in the Lower Green River showed an increase from eight percent in 1936 to 18 percent in 1993 (Fuerstenberg et al. 1996). That analysis also estimated that 45 percent of the riparian zone within 300 feet of the each riverbank was impervious surface in 1993.

3.2 Salmonid Populations and General Habitat Conditions

Despite extensive impacts to the habitat of the Lower Green River sub-watershed, the lower river provides habitat for several anadromous and resident fish populations. This section describes these populations and reviews the general status of fish habitat in the area.

3.2.1 Salmonids Present in the Lower Green River

Several populations of anadromous salmonids inhabit the Lower Green River, including chinook, coho (*O. kisutch*), chum (*O. keta*), sockeye (*O. nerka*), and pink salmon (*O. gorbuscha*), coastal cutthroat trout (*O. clarki clarki*) and steelhead (*O. mykiss*). Natural chinook, coho, chum, and steelhead populations are augmented by hatchery production. All anadromous salmonids use the Lower Green River for migration and rearing. Spawning in the Lower Green River has been documented for chinook, sockeye, chum, pink, and steelhead. Native char, i.e., bull trout (*Salvelinus confluentus*) and/or Dolly Varden (*S. malma*), were historically present in the Green River (Grette and Salo 1986), but juveniles have not been observed in the last 50 years and only solitary adults have been observed sporadically (E. Warner, Muckleshoot Tribe, personal communication, as

cited in R2 Resource Consultants 2001). Native resident salmonids in the basin include rainbow trout (*O. mykiss*) and mountain whitefish (*Prosopium williamsoni*).

Bull trout and Puget Sound chinook salmon are listed as threatened under the ESA. Historically, spring-run chinook occurred in the watershed but the diversion and damming of the watershed's rivers during the 20th century reduced their numbers, and they may have been extirpated. Pink salmon have exhibited a significant increase in recent years; in 2003, approximately 200,000 adult pinks returned to the Lower Green River, an increase from approximately 100 fish in 2001 (Croft , personal communication).

3.2.2 Salmonid Habitats

Historically, the Green River provided high quality habitat for anadromous and resident fish populations. However, due to dam operations in the upper river and extensive anthropogenic modifications in the lower part of the watershed (see Section 3.1.2), the Lower Green River no longer exhibits the habitat access, productive riparian zone, and well connected floodplain characteristic of high quality fish habitat. In fact, habitat loss and degradation is considered a primary factor in the decline of salmonid populations in the Lower Green River sub-watershed (Kerwin and Nelson 2000). The gradual channelization of the Lower Green River in the last century has resulted in substantial losses in quality and quantity of mainstem spawning, winter rearing, summer rearing, and adult holding habitat. Encroachment of land use, roads, trails and levees to the river margins has greatly reduced the extent of existing or potential riparian habitat. Bank tree cover is sparse, and the existing non-native vegetation provides little cover for fish. In the absence of riparian shade, high temperatures that are potentially lethal to salmonids have been documented in the Lower Green River (Grette and Salo 1986; Fishery Sciences, Inc. 1984; Caldwell 1994).